[redacted]

Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

November 29, 2012

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Unit 3
Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Licensee Event Report 50-296/2012-005-01**

Reference: Letter from TVA to NRC, "Licensee Event Report 50-296/2012-005-00," dated July 30, 2012.

In the referenced letter dated July 30, 2012, the Tennessee Valley Authority (TVA) submitted a Licensee Event Report containing details of an automatic reactor scram due to an actuation of a main transformer differential relay. Additional analysis was performed and TVA has revised the causal analysis. The TVA is submitting this supplemented report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(iv)(A) and 10 CFR 50.73(a)(2)(iv)(B).

There are no new regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact J. E. Emens, Jr., Nuclear Site Licensing Manager, at (256) 729-2636.

Respectfully,

[redacted]

K. J. Polson
Vice President

Enclosure: Licensee Event Report 50-296/2012-005-01 – Automatic Reactor Scram Due to an Actuation of a Main Transformer Differential Relay

cc (w/ Enclosure):
NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

IE22
NRR

ENCLOSURE

Browns Ferry Nuclear Plant,
Unit 3

Licensee Event Report 50-296/2012-005-01

Automatic Reactor Scram Due to an Actuation of a Main Transformer Differential Relay

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See Attached

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Browns Ferry Nuclear Plant, Unit 3	05000296	1 of 6

4. TITLE: Automatic Reactor Scram Due to an Actuation of a Main Transformer Differential Relay

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	05000
05	29	2012	2012	- 005 -	01	11	29	2012	FACILITY NAME: N/A	DOCKET NUMBER: 05000

9. OPERATING MODE

1

10. POWER LEVEL

076

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Eric Bates, Licensing Engineer	256-614-7180

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On May 29, 2012, at 0331 Central Daylight Time, the Browns Ferry Nuclear Plant (BFN), Unit 3, reactor automatically scrammed due to fast closure of turbine control valves, initiated by a load reject signal on the Main Generator. The cause of the load reject signal was actuation of newly installed main transformer differential relay 387T, which caused the scram. All systems responded as expected to the load reject signal. Main steam isolation valves remained open and reactor pressure was controlled by the main turbine bypass valves. No Emergency Core Cooling System or Reactor Core Isolation Cooling System reactor water level initiation set points were reached. Primary Containment Isolation System isolations from Groups 2, 3, 6, and 8 were received, and reactor water level was controlled by the Feedwater System.

Three root causes were identified: 1) inadequate procedure, instructions, and testing methodology/equipment used for current transformer (CT) bench testing; 2) inadequate acceptance review by Tennessee Valley Authority (TVA) Engineering of a vendor prepared design change; and 3) inadequate management, oversight, and accountability by the BFN Maintenance organization for work performed by the Protective Relay Group.

The corrective actions to prevent recurrence include: 1) revise the CT bench test procedure; 2) revise the human performance procedure to incorporate technical conscience principles, focus technical task risk factors, mitigating strategies, and decision making; and 3) using the Nuclear Operating Model, utilize the TVA's strategic performance management process to ensure management alignment in the ownership and accountability for leadership expectations at BFN.

NARRATIVE

I. PLANT CONDITION(S)

At the time of discovery, Browns Ferry Nuclear Plant (BFN), Unit 3, was in Mode 1 at approximately 76 percent power.

II. DESCRIPTION OF EVENT

A. Event

On May 29, 2012, at 0331 Central Daylight Time (CDT), the BFN, Unit 3, reactor automatically scrammed due to fast closure of turbine control valves [V] that was initiated by a load reject signal on the Main Generator [TB]. The cause of the load reject signal was the actuation of the newly installed main transformer differential relay [RLY] 387T which caused the scram.

All systems responded as expected to the load reject signal. Main steam isolation valves (MSIVs) remained open and reactor pressure was controlled on the main turbine bypass valves. No Emergency Core Cooling System (ECCS) [BJ][BO][BM][SB] or Reactor Core Isolation Cooling (RCIC) System [BN] reactor water level initiation set points were reached. Primary Containment Isolation System (PCIS) [BD] isolations from Groups 2, 3, 6, and 8 were received, and reactor water level was controlled by the Feedwater System [SJ].

B. Inoperable Structures, Components, or Systems that Contributed to the Event

There were no inoperable structures, components, or systems that contributed to the event.

C. Dates and Approximate Times of Major Occurrences

May 29, 2012, 0331 CDT	The BFN, Unit 3, reactor automatically scrammed due to fast closure of turbine control valves that was initiated by a load reject signal on the Main Generator.
May 29, 2012, 0622 CDT	The BFN reported the event to the NRC.

D. Other Systems or Secondary Functions Affected

There were no other systems or secondary functions affected.

E. Method of Discovery

This event was identified when the BFN, Unit 3, reactor was automatically scrammed due to actuation of the main transformer differential relay 387T.

F. Operator Actions

Operations personnel entered emergency operating instruction due to low reactor water level (below +2 inches).

G. Safety System Responses

All systems responded as expected to the load reject signal. MSIVs remained open and reactor pressure was controlled on the main turbine bypass valves. No ECCS or RCIC System reactor water level initiation set points were reached. PCIS isolations from Groups 2, 3, 6, and 8 were received, and reactor water level was controlled by the Feedwater System.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause of this event was the vendor (Asea Brown Boveri) manufactured a current transformer (CT) [XCT] with a reversed polarity and the Tennessee Valley Authority (TVA) installed this CT in the plant.

B. Root Cause

There were three root causes identified:

1. The Energy Delivery (ED) group procedure, TOM-FTM-6-INXF-002 (Testing Instrument Transformers), instructions and testing methodology/equipment were inadequate and did not meet the requirements of a Nuclear Power Group (NPG) procedure per NPG-SPP-01.2, Administration of Site Technical Procedures, such as inclusion of the human performance tools proven to reduce errors for testing high risk trip-sensitive CT components.
2. The TVA's acceptance review by Engineering of the design change prepared by an outside vendor was inadequate for modification to high risk trip-sensitive components.
3. Management, oversight, and accountability by the BFN Maintenance organization for work performed by the Protective Relay Group (PRG) were inadequate.

C. Contributing Factor

The written instructions for the on-line commissioning test of high risk trip-sensitive components were inadequate.

IV. ANALYSIS OF THE EVENT

The TVA is submitting this report in accordance with 10 CFR 50.73(a)(2)(iv)(A), as any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B), reactor protection system including: reactor scram or reactor trip.

The scram investigation identified that the main transformer differential relay 387T actuated because a manufacturing defect in a new generator bus CT caused an incorrect excitation input to the new main transformer differential relay 387T that was installed during the BFN, Unit 3, refueling outage 15. The manufacturing defect was the reversed polarity of a CT. Actuation of the main transformer differential relay 387T

caused the load reject that resulted in a reactor scram. Subsequent investigation revealed that the polarity of one of the 36 newly installed CTs was reversed giving the main transformer differential relay 387T a false signal.

This event was a result of multiple breakdowns in personnel performance. The lack of management oversight resulted in the use of a PRG technician who was not fully qualified to perform bench testing of the new CTs. The bench test of the new CTs was required to verify the CTs polarity. Since one of the 36 newly installed CTs polarity was reversed, it gave the main transformer differential relay 387T a false signal which resulted in a scram. The use of a test procedure, which did not include NPG human error prevention techniques, during the performance of the bench test by the PRG technician contributed to the failure to identify the faulty CT prior to installation. The lack of self checking by engineers and work planning resulted in the use of an inadequate test procedure that was not approved for use by NPG.

Extent of Condition

The extent of condition is limited to the CTs on the Common Service Station Transformer (CSST) [XFMR] differential circuits at BFN.

Extent of Cause

The extent of cause includes all ED group field test manual procedures used by PRG at TVA nuclear facilities, vendor prepared design changes on trip-sensitive components that have not yet been installed in the plant, and inadequate oversight, ownership, and accountability by BFN Management.

V. ASSESSMENT OF SAFETY CONSEQUENCES

All systems responded as expected to the load reject signal. MSIVs remained open and reactor pressure was controlled on the main turbine bypass valves. No ECCS or RCIC System reactor water level initiation set points were reached. PCIS isolations from Groups 2, 3, 6, and 8 were received, and reactor water level was controlled by the Feedwater System in the normal band.

Therefore, TVA concluded that there was no significant reduction to the health and safety of the public.

VI. CORRECTIVE ACTIONS - The corrective actions are being managed by TVA's corrective action program.

A. Immediate Corrective Actions

1. The CT polarity input to the main transformer differential relay 387T was corrected by swapping leads.
2. The polarity was tested satisfactorily on all remaining newly installed CTs.

B. Corrective Actions

1. Revised the vendor manual for the newly installed main transformer differential relay to provide adequate guidance on when and how to perform an on-line commissioning test.
2. Revise procedure NPG-SPP-09.3, Plant Modifications and Engineering Change Control, and procedure NPG-SPP-06.9.3, Post-Modification Testing, to require monitoring of all trip risk components that are capable of being monitored during return to operations.
3. Review the transformer and relay connections as well as the relay logic on the CSSTs at BFN to determine if a CT with reverse polarity would be self-revealing or if a field test will be required to ensure polarity is correct. For those CTs where reverse polarity is not considered self-revealing, enter the condition into the Corrective Action Program for resolution.
4. Revise the ED group field test manual procedures used by PRG at TVA nuclear facilities and issue as approved NPG procedures. The revised procedures will include required testing equipment and methodology, critical steps, second party verification, specific acceptance criteria, and NPG standards and expectations for human error techniques and risk sensitive activities.
5. Retested the new BFN, Unit 1, Main Generator CTs prior to their installation during BFN, Unit 1, refueling outage 9.
6. Revise procedure NEDP-5, Design Document Reviews, to establish definition, objective criteria, and requirements for each type of review (e.g., owner's acceptance review, technical review), and the situations when each type of review is appropriate.

C. Corrective Actions to Prevent Recurrence

1. Revise the CT bench test procedure TOM-FTM-6-INXF-002 and issue as an approved NPG procedure per NPG-SPP-01.2, Administration of Site Technical Procedures.
2. Revise procedure NPG-SPP-18.2.2, Human Performance, to incorporate technical conscience principles, focus technical task risk factors, mitigating strategies, and decision making.
3. Using the Nuclear Operating Model, utilize TVA's strategic performance management process to ensure management alignment in the ownership and accountability for leadership expectations at BFN.

VII. ADDITIONAL INFORMATION

A. Failed Components

There were no failed components.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
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NARRATIVE

B. Previous Similar Events

A search of BFN, Units 1, 2, and 3, LERs for approximately the past five years did not identify any similar events.

A search was performed on the BFN corrective action program. Similar concerns regarding management oversight, change management, and inadequate procedures were identified in problem evaluation reports (PERs) 139781, 151772, 162391, and 177395.

C. Additional Information

The corrective action document for this report is PER 558183.

D. Safety System Functional Failure Consideration

This event was not considered a safety system functional failure in accordance with NEI 99-02.

E. Scram With Complications Consideration

This event was not a complicated scram in accordance with NEI 99-02.

VIII. COMMITMENTS

There are no commitments.